

What is claimed is:

1. An asphalt-based roofing material comprising:
  - a substrate coated with an asphalt coating, the asphalt coating including an upper surface that is positioned above the substrate when the roofing material is installed on a roof, and a lower region that is positioned below the substrate when the roofing material is installed on the roof,
  - a protective coating adhered to the upper surface of the asphalt coating,
  - a surface layer of granules adhered to the protective coating, and
  - a web bonded to the lower region of the asphalt coating.

10

2. The roofing material of claim 1 which, when tested under impact resistance test UL 2218, exhibits an impact resistance improvement of at least two UL 2218 classes compared with the same roofing material without the web.

15

3. The roofing material of claim 2 which meets a UL 2218 Class 4 impact resistance standard.

20

4. The roofing material of claim 1 which, after aging by 60 days exposure to alternating cycles of concentrated solar radiation and water spray, then cooled to 14°F (-10°C) and subjected to a UL 2218 Class 4 impact, exhibits improved adhesion of the granules as measured by at least about 30% less granule loss in the area of impact compared with the same roofing material without the protective coating.

25

5. The roofing material of claim 1 including a portion that is normally exposed when the roofing material is installed on a roof, in which the protective coating covers at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material.

6. An asphalt-based roofing material including a portion that is normally exposed when the roofing material is installed on a roof, the roofing material comprising:

- a substrate coated with an asphalt coating, the asphalt coating including an  
5 upper surface that is positioned above the substrate when the roofing material is installed on the roof,
- a protective coating adhered to the upper surface of the asphalt coating, the protective coating covering at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material, and  
10 a surface layer of granules adhered to the protective coating.

7. The roofing material of claim 6 in which the protective coating substantially completely covers the upper surface of the asphalt coating in the exposed portion of the roofing material.

- 15
8. The roofing material of claim 6 in which the protective coating has an average thickness of at least about 1 mil (0.025 mm).

9. The roofing material of claim 6 in which the protective coating  
20 comprises an adhesive.

10. The roofing material of claim 9 in which the adhesive is selected so that the granules adhere to the adhesive predominantly by polar bonding.

11. The roofing material of claim 9 in which the adhesive is selected  
from the group consisting of ethylene-vinyl acetate copolymers, ethylene-vinyl  
acetate copolymers modified with styrene-butadiene-styrene block copolymers,  
ethylene-ethyl acetate copolymers, ethylene-n-butylacrylate polymers, ethylene-  
5 methacrylate polymers, styrene-isoprene-styrene block or graft copolymers,  
styrene-butadiene-styrene block or graft copolymers, other styrene-containing  
block or graft copolymers, polyamide terpolymers, hydrocarbon rubbers,  
polyethylenes, polyesters, polyurethanes, siloxanes, and mixtures of these  
materials.

10

12. The roofing material of claim 6 in which a substantially continuous  
layer of the protective coating is maintained between the asphalt coating and at  
least about 30% of the granules that penetrate the asphalt coating.

15

13. The roofing material of claim 6 which, after aging by 60 days  
exposure to alternating cycles of concentrated solar radiation and water spray,  
then cooled to 14°F (-10°C) and subjected to a UL 2218 Class 4 impact, exhibits  
improved adhesion of the granules as measured by at least about 30% less  
granule loss in the area of impact compared with the same roofing material  
20 without the protective coating.

14. An asphalt-based roofing material comprising:  
a substrate coated with an asphalt coating, the asphalt coating including an  
upper surface that is positioned above the substrate when the roofing material is  
installed on a roof,  
5 a protective coating adhered to the upper surface of the asphalt coating,  
and  
a surface layer of granules adhered to the protective coating, wherein at  
least a portion of the granules penetrate the asphalt coating, and wherein the  
protective coating provides a seal to prevent outside moisture from flowing  
10 around the granules to the asphalt coating.
15. The roofing material of claim 14 in which a substantially  
continuous layer of the protective coating is maintained between the asphalt  
coating and at least about 30% of the granules that penetrate the asphalt coating.
- 15
16. The roofing material of claim 14 in which the protective coating  
completely envelops a number of the granules within the range of from about  
0.5% to about 6% of the total granules.
- 20
17. A method of manufacturing an asphalt-based roofing material,  
comprising the steps of:  
coating a substrate with an asphalt coating, the asphalt coating including  
an upper surface that is positioned above the substrate when the roofing material  
is installed on a roof, and a lower region that is positioned below the substrate  
25 when the roofing material is installed on the roof,  
applying a protective coating to the upper surface of the asphalt coating,  
applying a surface layer of granules to the protective coating, and  
applying a web to the lower region of the asphalt coating.

18. The method of claim 17 in which the roofing material includes a portion that is normally exposed when the roofing material is installed on the roof, and in which the protective coating is applied to cover at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material.

5

19. The method of claim 18 in which the protective coating is applied to substantially completely cover the upper surface of the asphalt coating in the exposed portion of the roofing material.

10

20. The method of claim 17 in which the step of applying the protective coating comprises applying an adhesive.

15

21. The method of claim 17 in which the step of applying the protective coating comprises moving the asphalt-coated substrate at a speed of at least about 200 feet/minute (61 meters/minute) past an applicator to apply a layer of protective coating to the upper surface of the asphalt coating, the movement of the asphalt-coated substrate creating a boundary layer of air on the upper surface of the asphalt coating that can cause discontinuities in the protective coating layer, wherein the applicator is positioned sufficiently close to the upper surface of the asphalt coating to minimize the boundary layer and thereby form a protective coating layer that is at least about 90% continuous.

20

22. The method of claim 17 in which the step of applying the protective coating comprises providing a film of the protective coating and applying the film to the upper surface of the asphalt coating.

25

23. The method of claim 17 in which the lower region of the asphalt coating includes a lower surface, and in which the web is applied and fused to the lower surface.

30

24. A method of manufacturing an asphalt-based roofing material, comprising the steps of:

applying a web to a substrate,

5 coating the substrate and the web with an asphalt coating, the asphalt coating including an upper surface that is positioned above the substrate when the roofing material is installed on a roof, and a lower region that is positioned below the substrate when the roofing material is installed on the roof, wherein the web is in contact with the lower region of the asphalt coating,

10 applying a protective coating to the upper surface of the asphalt coating, and

applying a surface layer of granules to the protective coating.

25. The method of claim 24 in which the roofing material includes a portion that is normally exposed when the roofing material is installed on the roof, and in which the protective coating is applied to cover at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material.

20 26. The method of claim 25 in which the protective coating is applied to substantially completely cover the upper surface of the asphalt coating in the exposed portion of the roofing material.

27. The method of claim 24 in which the step of applying the protective coating comprises applying an adhesive.

28. The method of claim 24 in which the step of applying the protective coating comprises moving the asphalt-coated substrate and web at a speed of at least about 200 feet/minute (61 meters/minute) past an applicator to apply a layer of protective coating to the upper surface of the asphalt coating, the

movement of the asphalt-coated substrate and web creating a boundary layer of air on the upper surface of the asphalt coating that can cause discontinuities in the protective coating layer, wherein the applicator is positioned sufficiently close to the upper surface of the asphalt coating to minimize the boundary layer and thereby form a protective coating layer that is at least about 90% continuous.

29. The method of claim 24 in which the step of applying the protective coating comprises providing a film of the protective coating and applying the film to the upper surface of the asphalt coating.

10

30. The method of claim 24 in which the lower region of the asphalt coating includes a lower surface, and in which the web is applied and fused to the lower surface.

31. A method of manufacturing an asphalt-based roofing material, comprising the steps of:

coating a substrate with an asphalt coating, the asphalt coating including an upper surface that is positioned above the substrate when the roofing material  
5 is installed on a roof,

moving the asphalt-coated substrate at a speed of at least about 200 feet/minute (61 meters/minute) past an applicator to apply a layer of protective coating to the upper surface of the asphalt coating, the movement of the asphalt-coated substrate creating a boundary layer of air on the upper surface of the  
10 asphalt coating that can cause discontinuities in the protective coating layer, wherein the applicator is positioned sufficiently close to the upper surface of the asphalt coating to minimize the boundary layer and thereby form a protective coating layer that is at least about 90% continuous, and

15 applying a surface layer of granules to the protective coating.

32. The method of claim 31 in which the applicator is positioned within about 0.1 inch (0.254 cm) of the upper surface of the asphalt coating.

33. The method of claim 32 in which the applicator is positioned in  
20 contact with the upper surface of the asphalt coating.

34. The method of claim 31 in which the roofing material includes a portion that is normally exposed when the roofing material is installed on the roof, and in which the protective coating layer is applied to cover at least about  
25 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material.

35. The method of claim 31 in which the step of applying the protective coating layer comprises applying an adhesive.

36. A method of manufacturing an asphalt-based roofing material, comprising the steps of:

coating a substrate with an asphalt coating, the asphalt coating including an upper surface that is positioned above the substrate when the roofing material  
5 is installed on a roof,

providing a film of a protective coating material,

applying the film to the upper surface of the asphalt coating, and

applying a surface layer of granules to the film.

10 37. The method of claim 36 in which the roofing material includes a portion that is normally exposed when the roofing material is installed on the roof, and in which the film is applied to cover at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material.

15 38. The method of claim 37 in which the film is applied to substantially completely cover the upper surface of the asphalt coating in the exposed portion of the roofing material.

20 39. The method of claim 36 in which the protective coating material is an adhesive.

40. A method of manufacturing an asphalt-based roofing material, comprising the steps of:

mixing a protective coating material with an asphalt coating,

coating a substrate with the mixture of protective coating material and  
5 asphalt coating,

heating the mixture to cause the protective coating material to separate from the asphalt coating and form a layer on an upper surface of the asphalt coating, and

10 applying a surface layer of granules to the layer of protective coating material.

41. A method of manufacturing an asphalt-based roofing material, the roofing material including a portion that is normally exposed when the roofing material is installed on a roof, comprising the steps of:

15 coating a substrate with an asphalt coating, the asphalt coating including an upper surface that is positioned above the substrate when the roofing material is installed on the roof,

20 applying a protective coating to the upper surface of the asphalt coating to cover at least about 80% of the upper surface of the asphalt coating in the exposed portion of the roofing material, and

applying a surface layer of granules to the protective coating.

42. The method of claim 41 in which the protective coating is applied to substantially completely cover the upper surface of the asphalt coating in the  
25 exposed portion of the roofing material.

43. The method of claim 41 in which the step of applying the protective coating comprises applying an adhesive.